Pocket Cable Guide

Magnavox
CATV Systems

Pocket Cable Guide

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TABLE OF CONTENTS

Page

General Information on CATV

Ohm's Law & Joule's Law 4
dB & dBmV Definitions 5
dBmV/Microvolt Correspondence 6
Return Loss, Reflection, & VSWR 7
Distortion Formulas: C/N & X-Mod 8
Distortion Formulas: 2nd Order & CTB 9
Noise & Distortion Measurements for a System
— Measuring C/N, Comp. 2nd Order, or CTB with a Spectrum Analyzer 10-12
— Cable TV Channel Format 13
— Measuring C/N with a Signal Level Meter 14,15
Combining Two X-Mod or CTB Levels 16
Combining Two Carrier-to-Noise Measures 17
Cable Resistance 18
Mechanical Specs for Cable 19
Cable Attenuation by Frequency 20,21
Cable-Loss Conversion Chart 22,23
Temperature and Cable Loss 24
Rules of Thumb 25
Broadband Level & Slope Charts 26-29
TV Channel Frequencies 30-34
FM Broadcast Channel Frequencies 35
The Magnavox CATV Frequency Allocation Chart 36,37
Mainstations Operating Levels & Design Criteria (Fill-in Sheets)
— The Forward Path 38
— The Return Path 39
Feederline Operating Levels & Design Criteria (Fill-in Sheets)
— The Forward Path 40
— The Return Path 41
Hook-Ups for Cable/VCR Combinations 42-48

Page

Information on Magnavox Products

Diagram for 600/550 MHz ISIS Mainstations 50,51
Diagram for Sub-Split Mainstations 52
Diagram for Mid-Split Mainstations..... 53
Selecting an Attenuator for an Active Module 54
dB Values for Equalizers & Attenuators 55
Selecting an Equalizer for an Active Module 56,57
Equalizer & Attenuator Selection Chart 58,59
Connector Pin Lengths 60,61
Specs for 8000 Series Taps 62,63
Specs for Line Splitters & Directional Couplers 64,65
Torque Specs for Mainstations 66
Torque Specs for Feederline Equipment 67
Distributing Power from Line Power Supplies 68-72

NOTE: All specifications cited in this booklet are subject to change without notice.

OHM'S LAW & JOULE'S LAW

Ohm's Law

$V = I R$

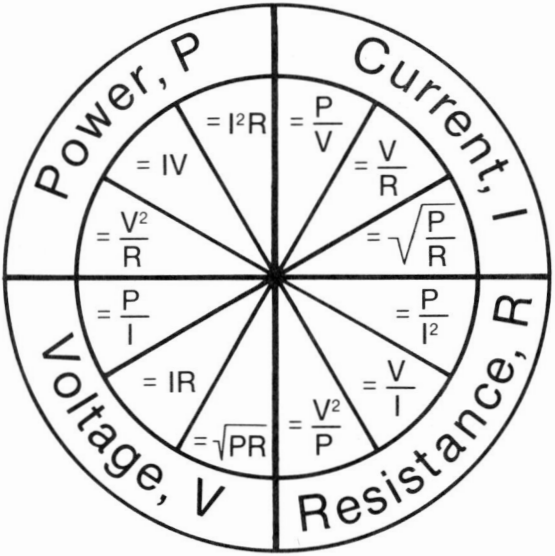
V = voltage in volts
I = current in amperes
R = resistance in ohms

Joule's Law

$P = I V$

P = power in watts
I = current in amperes
V = voltage in volts

Equations Crossbred from Ohm's & Joule's Laws



dB & dBmV DEFINITIONS

— The logarithmic ratio of two signal power figures is expressed in dB.

$$\text{Gain in dB} = 10 \log \frac{X_2}{X_1}$$

— To express Power Gain directly, use this equation:

$$\text{Power Gain in dB} = 10 \log \frac{P_2}{P_1}$$

— To express Power Gain in terms of voltage or current, use these equations.

$$\text{Power Gain in dB} = 10 \log \frac{P_2}{P_1} = 10 \log \left(\frac{V_2}{V_1} \right)^2 = 20 \log \frac{V_2}{V_1}$$

$$\text{Power Gain in dB} = 10 \log \frac{P_2}{P_1} = 10 \log \left(\frac{I_2}{I_1} \right)^2 = 20 \log \frac{I_2}{I_1}$$

These equations are true because we can express power as being directly proportional either to voltage ($P = V^2/R$) or to current ($P = I^2R$). Since the standard impedance for CATV circuits is 75 ohms, the resistance terms (R_1 and R_2, not shown explicitly above) cancel each other in the quotient P_2/P_1. Thus we can find Power Gain in terms of either Voltage-Squared Gain or Current-Squared Gain in a CATV circuit. We can translate 10 log ( )^2 to 20 log ( ) because of a general rule of logarithmic algebra: log M^q = q log M.

— Signal power levels expressed in dBmV are logarithmic "multiples" of a standard reference power level, i.e., (1 mV)^2 in or across a 75Ω impedance. The dBmV is a unit of signal power, not voltage.

Figures cited in dB, such as gain or distortion figures, express a proportion in logarithmic form: an amplifier gain figure expresses the ratio of an output signal to an input signal logarithmically; a distortion figure, like CTB, expresses the ratio of undesired signal to desired signal logarithmically. By contrast, signal power figures cited in dBmV express an absolute signal power level.

To define "dBmV" then, we may say:

0 dBmV *corresponds to* 1 mV across a 75Ω impedance, or

0 dBmV *equals* (1 mV)^2 in a 75Ω impedance.

dBmV/MICROVOLT CORRESPONDENCE*

0 dBmV = (1 mV)² across a 75-ohm impedance

dBmV	μV	dBmV	μV	dBmV	μV	dBmV	μV
-60	1.00	-24	63.10	12	3,981	48	251,200
-59	1.12	-23	70.79	13	4,467	49	281,800
-58	1.26	-22	79.43	14	5,012	50	316,200
-57	1.41	-21	89.13	15	5,623	51	534,800
-56	1.58	-20	100.0	16	6,310	52	398,100
-55	1.78	-19	112.2	17	7,079	53	446,700
-54	1.99	-18	125.9	18	7,943	54	501,200
-53	2.24	-17	141.3	19	8,913	55	562,300
-52	2.51	-16	158.5	20	10,000	56	631,000
-51	2.82	-15	177.8	21	11,220	57	707,900
-50	3.16	-14	199.5	22	12,590	58	793,300
-49	3.55	-13	223.9	23	14,130	59	891,300
-48	3.98	-12	251.2	24	15,850	60	1,000,000
-47	4.47	-11	281.8	25	17,780	61	1,122,000
-46	5.01	-10	316.2	26	19,950	62	1,259,000
-45	5.62	-9	354.8	27	22,390	63	1,413,000
-44	6.31	-8	398.1	28	25,120	64	1,585,000
-43	7,08	-7	446.7	29	28,180	65	1,788,000
-42	7.94	-6	501.2	30	31,620	66	1,995,000
-41	8.91	-5	562.3	31	35,480	67	2,239,000
-40	10.00	-4	631.0	32	39,810	68	2,512,000
-39	11.22	-3	707.9	33	44,670	69	2,818,000
-38	12.59	-2	794.3	34	50,120	70	3,162,000
-37	14.13	-1	891.3	35	56,230	71	3,548,000
-36	15.85	0	1,000	36	63,100	72	3,981,000
-35	17.78	1	1,122	37	70,790	73	4,467,000
-34	19.95	2	1,259	38	79,430	74	5,012,000
-33	22.39	3	1,413	39	89,130	75	5,623,000
-32	25.12	4	1,585	40	100,000	76	6,310,000
-31	28.18	5	1,778	41	112,200	77	7,079,000
-30	31.62	6	1,995	42	125,900	78	7,943,000
-29	35.48	7	2,239	43	141,300	79	8,913,000
-28	39.81	8	2,512	44	158,500	80	10,000,00
-27	44.67	9	2,818	45	177,800		
-26	50.12	10	3,162	46	199,500		
-25	56.23	11	3,548	47	223,900		

*By definition, the dBmV is not a unit of voltage; rather it is a unit of power expressed in terms of a voltage (i.e., a voltage squared) in a standard 75-ohm impedance. You can think of signal power figures expressed in dBmV as logarithmic "multiples" of *(1 mV)² across 75 ohms.*

RETURN LOSS, REFLECTION, & VSWR

Return Loss dB Down	Reflection Coefficient %	VSWR	Return Loss dB Down	Reflection Coefficient %	VSWR
0.0	100.00	-	15.5	16.8	1.40
0.5	94.4	34.7	16.0	15.9	1.38
1.0	89.1	17.3	16.5	15.0	1.35
1.5	84.1	11.6	17.0	14.1	1.33
2.0	79.4	8.71	17.5	13.3	1.31
2.5	75.0	7.00	18.0	12.6	1.29
3.0	70.8	5.85	18.5	11.9	1.27
3.5	66.8	5.02	19.0	11.2	1.25
4.0	63.1	4.42	19.5	10.6	1.233
4.5	59.6	3.95	20.0	10.0	1.222
5.0	56.2	3.57	20.5	9.44	1.208
5.5	53.1	3.26	21.0	8.91	1.196
6.0	50.1	3.01	21.5	8.41	1.184
6.5	47.3	2.80	22.0	7.94	1.172
7.0	44.7	2.62	22.5	7.50	1.162
7.5	42.2	2.46	23.0	7.08	1.152
8.0	39.8	2.32	23.5	6.68	1.143
8.5	37.6	2.21	24.0	6.31	1.135
9.0	35.5	2.10	24.5	5.96	1.127
9.5	33.5	2.01	25.0	5.62	1.119
10.0	31.6	1.92	25.5	5.31	1.112
10.5	29.9	1.85	26.0	5.01	1.105
11.0	28.2	1.79	26.5	4.73	1.099
11.5	26.6	1.72	27.0	4.47	1.094
12.0	25.1	1.67	27.5	4.22	1.088
12.5	23.7	1.62	28.0	3.98	1.083
13.0	22.4	1.58	28.5	3.76	1.078
13.5	21.1	1.53	29.0	3.55	1.074
14.0	20.0	1.50	29.5	3.35	1.069
14.5	18.8	1.46	30.0	3.16	1.065
15.0	17.8	1.43	30.5	2.99	1.062

DISTORTION FORMULAS

Carrier-to-Noise & X-Mod

Carrier-to-Noise for a single amplifier:

$$CN_1 = 59 + \text{Input Level} - \text{Noise Figure}^*$$

Carrier-to-Noise for a cascade of k identical amplifiers:

$$CN_k = CN_1 - 10 \log(k)$$

X-Mod for a single amplifier:

$$XMod_1 = \left[\begin{array}{c}\text{Manufacturer's} \\ \text{XMod Spec}\end{array}\right] + 2\left[\begin{array}{c}\text{Manufacturer's} \\ \text{Rated Output Level}\end{array} - \begin{array}{c}\text{Actual} \\ \text{Output Level}\end{array}\right]$$

X-Mod for a cascade of k amplifiers:

$$XMod_k = XMod_1 - 20 \log(k)$$

Note: In these formulas, we express both carrier-to-noise and cross modulation as a positive ratio of desired signal to undesired signal (noise or X-Mod). If a manufacturer reports negative numbers for X-Mod, drop the minus sign for use here.

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*Noise Figure expressions may vary from the manufacturer's published specifications because of add-on components like attenuators and equalizers. Add 2 dB to Magnavox's published Noise Figures.

DISTORTION FORMULAS

Second Order & CTB

Second Order Distortion (SOD) for a single amplifier:

$$SOD_1 = \left[\begin{array}{c}\text{Manufacturer's}\\ \text{2nd Order Spec}\end{array}\right] + \left[\begin{array}{c}\text{Manufacturer's}\\ \text{Rated Output Level}\end{array} - \begin{array}{c}\text{Actual}\\ \text{Output Level}\end{array}\right]$$

Second Order Distortion (SOD) for a cascade of k amplifiers:

$$SOD_k = SOD_1 = 10 \log(k)$$

Composite Triple Beat (CTB) for a single amplifier:

$$CTB_1 = \left[\begin{array}{c}\text{Manufacturer's}\\ \text{CTB Spec}\end{array}\right] + 2\left[\begin{array}{c}\text{Manufacturer's Rated}\\ \text{Output Level}\end{array} - \begin{array}{c}\text{Actual}\\ \text{Output Level}\end{array}\right]$$

Composite Triple Beat (CTB) for a cascade of k amplifiers:

$$CTB_k = CTB_1 - 20 \log(k)$$

Note: In these formulas, we express both 2nd Order and CTB distortion as a positive ratio of desired signal to undesired signal. If a manufacturer reports negative numbers for these distortion parameters, drop the minus sign for use here.

NOISE & DISTORTION MEASUREMENTS FOR A SYSTEM

Measuring C/N, Composite 2nd Order, or CTB with a Spectrum Analyzer

Equipment Needed:

(1) Spectrum Analyzer
(2) Tuneable or Fixed Channel Bandpass Filter (Ch 2, 5 or A)
(3) Low-Noise Post-Amplifier (not needed in all cases)
(4) Two 2-Way Radios.

Personnel Needed:

It takes two technicians to do this procedure, one at the test site to take measurements with the spectrum analyzer, and one at the headend to turn off the power for the channel being tested and turn it on again as directed. These two technicians should communicate via two-way radios.

Spectrum Analyzer Adjustments:

Set your spectrum analyzer in accordance with the manufacturer's recommendations for C/N, Comp. 2nd Order, & CTB.

Spectrum Analyzer Adjustments

	SETTINGS FOR:		
Parameter	**C/N**	**Composite 2nd Order**	**CTB**
Video Bandwidth	_____	_____	_____
Resolution Bandwidth	_____	_____	_____
Frequency Span Width	_____	_____	_____
Sweep Time	_____	_____	_____
Attenuator	_____	_____	_____
dB per Division	_____	_____	_____
Correction Factor	_____	_____	_____

Noise & Distortion Standards

Parameter	FCC Requirement	Magnavox Recommendation
Carrier-to-Noise	36 dB	44 dB
Carrier-to-X-Mod	46 dB	52 dB
Carrier-to-Discr. 2nd Order	46 dB	62 dB
Carrier-to-Comp. 2nd Order	46 dB	52 dB
Carrier-to-Discr. 3rd Order	46 dB	65 dB
Carrier-to-CTB	46 dB	53 dB (Std.) 51 dB (IRC) 49 dB (HRC)

The technician at the test site should follow these steps.

1. To measure carrier-to-noise, composite 2nd order, or composite triple beat, a spectrum analyzer needs an input signal level of at least 30 dBmV. In the Mainstation, the broadband signal appears at a level well above 30 dBmV where the Bridger's output enters the Bridger Splitter, i.e., at Chassis connector P8 (remove the 5-S Bridger Splitter for access). *NOTE: Removing the Bridger Splitter will interrupt service to customers served via adjoining feederlines.* On the feederline, you can get a signal sample above 30 dBmV at a tap just downstream from the last active device: you must replace that tap plate with one that gives you signals of 30 dBmV or more. In some cases, you may need to run feeder signals through a low-noise post-amplifier to get an adequate test signal level. *NOTE: Removing the tap plate will interrupt service to customers served from that tap.* If you use a low-noise pre-amplifier, you may get an adequate signal level without changing tap plates. In such cases, take your signal sample from an unused tap port, whenever possible, to avoid service interruptions.

2. Introduce the broadband signal into the bandpass filter. This filter, whether fixed or tuneable, must pass the 6 MHz channel you have chosen for testing, i.e., Ch 2, Ch 5, or Ch A.

3. Introduce the bandpass filter's output into the spectrum analyzer.

Measuring C/N, Composite 2nd Order, or CTB with a Spectrum Analyzer (Cont'd)

4. Tune the spectrum analyzer to the visual carrier of the channel being tested. Position the visual carrier's peak on the center vertical graticule line of the display.

5. Tune the bandpass filter to "peak" the visual carrier, i.e., tune it so it attenuates the visual carrier as little as possible.

6. Adjust the analyzer's built-in attenuator and reference-level control to place the visual carrier's peak on the top horizontal graticule line. This will be the reference line for the measurement.

7. Tell the technician at the headend to turn off the power for the channel being tested.

8. Read relative level of undesired signal component.

   (a) **For C/N Measurement**. Count down in dB from the top graticule line to the noise floor. Read the noise floor 500 kHz away (either to the left or right) from the center vertical graticule line.

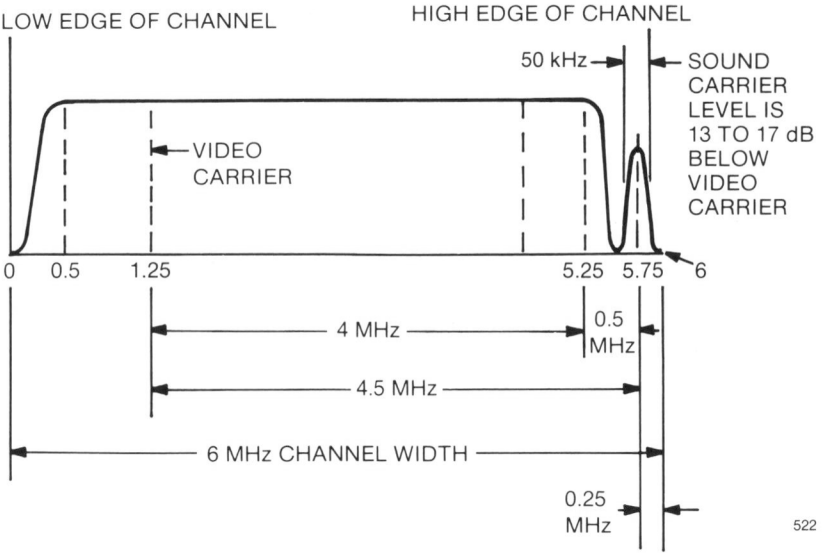
   (b) **For Composite 2nd Order Measurement**. Count down in dB from the top graticule line to read the level of composite 2nd order distortion at these four frequencies: 750 kHz and 1.25 MHz away from the center vertical graticule line, both to the right and to the left. Note the worst of these four readings if they differ.

   (c) **For CTB Measurement**. Count down in dB from the top graticule line to read the level of composite triple beat. Take this reading on the center vertical graticule line.

9. Subtract the spectrum analyzer's correction factor from your reading in Step 8. This result tells you the ratio in dB of desired signal to the particular undesired signal component, i.e., Carrier-to-Noise, Carrier-to-Composite 2nd Order, or Carrier-to-CTB.

10. Tell the technician at the headend to turn the power for the test channel back on again.

CABLE TV CHANNEL FORMAT



522

NOISE & DISTORTION MEASUREMENTS FOR A SYSTEM

Measuring C/N with a Signal Level Meter

Model # of Signal Level Meter _____

Correction Factor for Meter _____

1. To measure carrier-to-noise, a signal level meter needs an input level of at least 30 dBmV. In the Mainstation, the broadband signal appears at a level well above 30 dBmV where the Bridger's output enters the Bridger Splitter, i.e., at Chassis connector P8 (remove the 5-S Bridger Splitter for access). *NOTE: Removing the Bridger Splitter will interrupt service to customers served via adjoining feederlines.* On the feederline, you can get a signal sample above 30 dBmV at a tap just downstream from the last active device: you must replace that tap plate with one that gives you signals of 30 dBmV or more. In some cases, you may need to run feeder signals through a low-noise post-amplifier to get an adequate test signal level. *NOTE: Removing the tap plate will interrupt service to customers served from that tap.*

2. Introduce the signal from Step 1 into the signal level meter.

3. Tune the signal level meter to the visual carrier frequency of a channel that has no channel directly below it, e.g., Ch 2, Ch 5, or Ch A.

4. Adjust the meter's built-in attenuator, adding attenuation if necessary so that the meter's needle is not "pegged" at its maximum reading.

5. Use the meter's fine-tuning control to find the peak amplitude of the channel's visual carrier, and note the signal level reading (e.g., 20 dBmV).

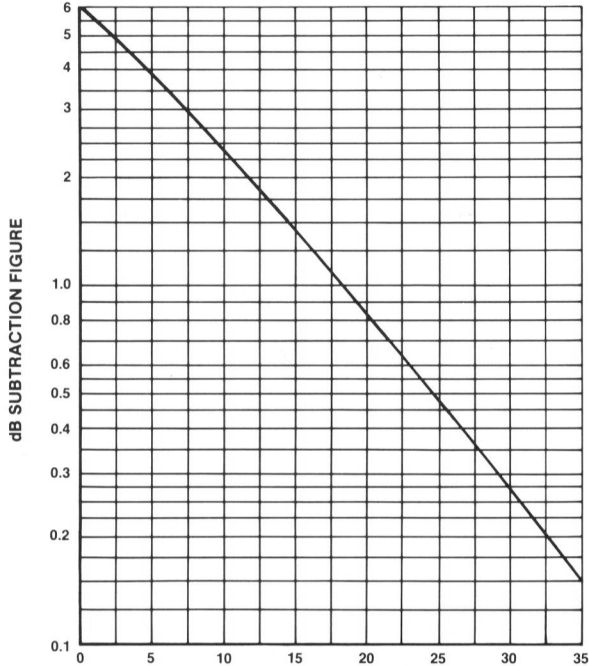
6. Using the meter's fine-tuning control, tune to a frequency just below, but clear of, the visual carrier.

7. Remove meter attenuation until the needle moves from its minimum reading. Adjust the fine tuning control to confirm that you have found the true noise floor. Note the level of the noise (e.g., -25 dBmV).

8. Subtract the noise level (Step 7) from the carrier level (Step 5), e.g., 20 - (-25) = 45 dB.

9. Look up the meter's correction factor in the manufacturer's literature (e.g., 4.5 dB) and subtract this number from the result in Step 8 (e.g., 45 - 4.5 = 40.5 dB Carrier-to-Noise). This result is the carrier-to-noise ratio in dB.

COMBINING TWO X-MOD OR CTB LEVELS

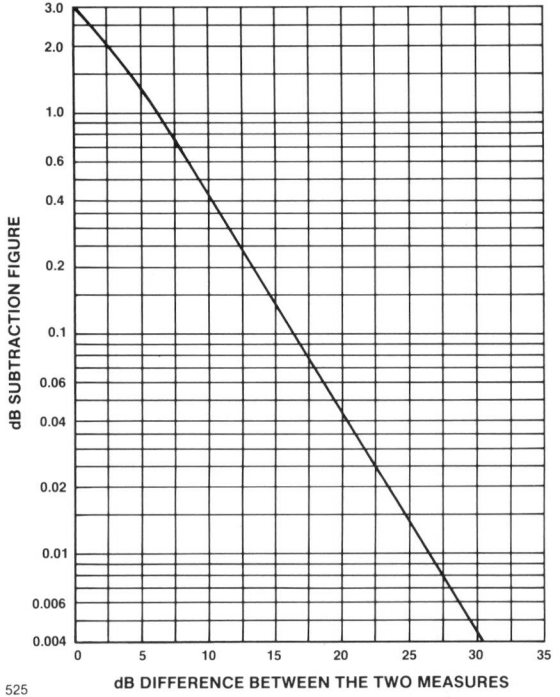


524

Example: Combine trunk and bridger CTB levels to find the resultant CTB figure in the feeder line (no line extenders).

Trunk CTB = -60.3 dB Bridger CTB = -52.8 dB
dB Difference = 60.3 - 52.8 = 7.5 dB
dB Subtraction Figure ≅ 3.1 dB
Resultant Feeder CTB ≅ 52.8 - 3.1 ≅ 49.7 dB
So then, the resultant CTB level is about -49.7 dB.

COMBINING TWO CARRIER-TO-NOISE MEASURES



525

Example: Combine trunk and bridger carrier-to-noise measures to find the resultant carrier-to-noise figure in the feeder line (no line extenders).

Trunk C/N = 50 dB Bridger C/N = 43 dB
dB Difference = 50 - 43 = 7 dB
dB Subtraction Figure = .8 dB
Resultant Feeder C/N = 43 - .8 = 42.2 dB
So then, the resultant C/N measure is about 42.2 dB.

TYPICAL CABLE RESISTANCE — Gas Injected Cable

Maximum DC resistance @ 68°F expressed in ohms per 1000 ft.

	Cable Size (inches)						Your Cable
	0.412	**0.500**	**0.625**	**0.750**	**0.875**	**1.000**	
Copper-Clad Aluminum Center Conductor							
Loop	2.43	1.68	1.07	0.76	0.55	0.40	___
Center	1.93	1.29	0.84	0.57	0.42	0.32	___
Sheath	0.50	0.39	0.23	0.19	0.13	0.08	___
Solid Copper Center Conductor							
Loop	1.76	1.23	0.79	0.56	0.41	---	___
Center	1.25	0.83	0.56	0.37	0.28	---	___
Sheath	0.51	0.40	0.23	0.19	0.13	---	___

TYPICAL MECHANICAL SPECIFICATIONS - Gas Injected Cable

	Cable Size					
	0.412	**0.500**	**0.625**	**0.750**	**0.875**	**1.000**
Diameters (inches)						
Center Conductor	0.089	0.111	0.137	0.169	0.194	0.220
Dielectric	0.362	0.450	0.563	0.678	0.797	0.890
Outer Conductor	0.412	0.500	0.625	0.750	0.875	1.000
Jacket (Jkt'd Versions)	0.512	0.560	0.685	0.820	0.945	1.08
Armor (Armor'd Versions)	0.590	0.635	0.755	0.920	1.107	1.18
Outer Jacket (Armr'd Vers.)	0.670	0.715	0.835	1.00	1.097	1.26
Messenger (Msngr Vers.)	0.109	0.109	0.109	0.250	0.250	0.250
Thickness (inches)						
Outer Conductor	0.025	0.025	0.031	0.036	0.039	0.055
Jkt. Wall (Jkt'd Vers.)	0.050	0.030	0.030	0.035	0.035	0.040
Shield (Armr'd Vers.)	0.008	0.008	0.008	0.008	0.008	0.008
Outer Jkt. (Armr'd Vers.)	0.040	0.040	0.040	0.040	0.040	0.040
Min. Bend Radius (in.)						
Armored	9.0	10.5	11.5	12.5	16.0	18
No Armor	7.0	8.0	9.0	10.0	13.5	15
Maximum Pull Force (lbs)	150	200	295	420	435	490
Min. Breaking Force of Messenger (lb)	1800	1800	1800	6650	6650	6650
Length per Reel (ft)	3000	2400	2500	2500	2500	2400
Reel Size (Flange x Hub x Traverse) (in.)	35x16x18	35x16x18	41x24x24	53x30x24	57x35x24	63x40x26
Weight per Foot (lb/ft)						
Jacketed Solid Copper	.088	.119	.177	.256	.332	— —
Jacketed Copper - Clad Al	.073	.096	.142	.202	.257	.365

TYPICAL CABLE ATTENUATION BY FREQUENCY

Gas Injected Cable

Maximum attenuation @ 68°F expressed in dB per 100 ft.

Freq. (MHz)	Cable Size (inches) 0.412	0.500	0.625	0.750	0.875	1.000	Your Cable ___	___
5	0.20	0.16	0.13	0.11	0.09	0.09	___	___
30	0.50	0.40	0.34	0.26	0.24	0.23	___	___
45	0.61	0.49	0.41	0.33	0.30	0.28	___	___
50	0.64	0.52	0.44	0.35	0.32	0.30	___	___
55	0.67	0.54	0.46	0.37	0.33	0.31	___	___
83	0.83	0.66	0.57	0.46	0.41	0.39	___	___
108	0.96	0.75	0.65	0.52	0.47	0.44	___	___
150	1.14	0.90	0.77	0.62	0.55	0.52	___	___
181	1.24	1.00	0.85	0.68	0.60	0.59	___	___
193	1.28	1.03	0.88	0.71	0.62	0.60	___	___
211	1.35	1.09	0.92	0.74	0.66	0.62	___	___
220	1.37	1.11	0.94	0.76	0.67	0.63	___	___

Variation with temperature: 1% per 10 F degrees. Temperature rise increases attenuation. See sample problem on page 24.

TYPICAL CABLE ATTENUATION BY FREQUENCY

Gas Injected Cable

Maximum attenuation @ 68°F expressed in dB per 100 ft.

Freq. (MHz)	Cable Size (inches) 0.412	0.500	0.625	0.750	0.875	1.000	Your Cable ___	___
250	1.46	1.20	1.00	0.81	0.72	0.68	___	___
270	1.53	1.24	1.05	0.85	0.75	0.71	___	___
300	1.63	1.31	1.10	0.90	0.79	0.75	___	___
325	1.75	1.37	1.15	0.94	0.82	0.78	___	___
350	1.78	1.43	1.20	0.97	0.86	0.81	___	___
375	1.83	1.47	1.23	1.01	0.89	0.84	___	___
400	1.90	1.53	1.28	1.05	0.91	0.87	___	___
425	1.97	1.57	1.32	1.08	0.95	0.90	___	___
450	2.05	1.63	1.35	1.12	0.98	0.92	___	___
500	2.15	1.73	1.43	1.18	1.03	0.98	___	___
550	2.25	1.82	1.50	1.24	1.08	1.03	___	___
600	2.35	1.87	1.60	1.30	1.12	1.08	___	___

Variation with temperature: 1% per 10 F degrees. Temperature rise increases attenuation. See sample problem on page 24.

CABLE-LOSS CONVERSON CHART

This chart helps you find a cable span's attenuation at a new frequency if you know its attenuation at one frequency.

1. Choose the two frequencies of interest.
2. If you know the cable loss at f_1 and want to find the corresponding loss at a higher frequency f_2, *multiply* the loss at f_1 by the conversion factor. The result is the cable loss at f_2.
3. If you know the cable loss at f_2 and want to find the corresponding loss at a lower frequency f_1, *divide* the loss at f_2 by the conversion factor. The result is the cable loss at f_1.

f_1 (MHz)	f_2 (MHz)	Conversion Factor
220	270	1.108
220	300	1.168
220	330	1.225
220	400	1.348
220	440	1.414
220	500	1.508
220	550	1.581
220	600	1.651
270	300	1.054
270	330	1.106
270	400	1.217
270	440	1.277
270	500	1.361
270	550	1.427
270	600	1.491
300	330	1.049
300	400	1.155
300	440	1.211
300	500	1.291
330	550	1.354
300	600	1.414

CABLE-LOSS CONVERSION CHART (Cont'd)

f_1 (MHz)	f_2 (MHz)	Conversion Factor
330	400	1.101
330	440	1.155
330	500	1.231
330	550	1.291
330	600	1.348
400	440	1.049
400	500	1.118
400	550	1.173
400	600	1.225
440	500	1.066
440	550	1.118
440	600	1.168
500	550	1.049
500	600	1.095
550	600	1.044

Conversion Factor = $\sqrt{\frac{f_2}{f_1}}$

Example: If a cable span attenuates a 220 MHz signal by 10 dB, by how much will it attenuate a 300 MHz signal?

Loss at 300 MHz = Loss at 220 MHz x Conversion Factor

= 10 dB x 1.168

= 11.68 dB

TEMPERATURE AND CABLE LOSS

An Example

This equation calculates *the percentage of change* in cable attenuation (loss) caused by a temperature change:

$$\% \text{ change in cable loss} = 1\% \text{ per } 10\ F^\circ$$

This equation calculates *the change* in cable loss in a span of cable, expressed in dB:

Change in cable loss (in dB) =
Standard loss x % Change in cable loss

EXAMPLE: If the standard loss between Mainstations is 22 dB* when the temperature is 70° F and the temperature drops to -40° F, what is the change in attenuation for that cable span?

(a) First, determine the number of degrees of temperature change:

$$T = T_2 - T_1 = (-40^\circ F) - 70^\circ F = (-110F^\circ)$$

(b) Next, find the percent change in cable loss:

$$\begin{aligned} \% \text{ change} &= 1\% \text{ per } 10\ F^\circ \times (-110\ F^\circ) \\ &= (1\%/10F^\circ) \times (-110\ F^\circ) \\ &= -11\% \end{aligned}$$

(c) Finally, find the dB change in the span's loss:

$$\begin{aligned} \text{Change in cable loss (in dB)} &= -11\% \times 22\ dB \\ &= -2.42\ dB \end{aligned}$$

If the span's loss was 22 dB at 70° F, it becomes 22 dB + (-2.42 dB) = 19.58 dB at -40° F.

Changes in cable loss accumulate over multiple cable spans and can cause distortion if not controlled by AGC/ASC units.

---

*The length of a cable span specified in dB will vary according to diameter. E.g., 22dB of cable at, say 450 MHz, could mean 1739 feet of ¾" cable or 1212 feet of ½" cable.

RULES OF THUMB

Cable-Loss and Signal Frequency

A coaxial cable attenuates the signal passing through it by an amount that varies with the signal's frequency. High signals are attenuated more than low signals, and the degree of attenuation increases exponentially with frequency.

Rule of Thumb: Cable attenuation (in dB) doubles as frequency quadruples (4X).

For example, if a broadband signal passes through enough cable to attenuate a 54 MHz signal by 5 dB, signals at (4 x 54 =) 216 MHz will be attenuated by (2 x 5 =) 10 dB.

Peak-to-Valley Deviation

To determine what degree of overall peak-to-valley deviation is acceptable for the kth Mainstation in a cascade, use this formula.

Rule of Thumb: Acceptable Pk-Vlly Deviation (dB) = $\frac{k}{10} + 1$

Example:

What is the maximum acceptable peak-to-valley deviation for the 32nd Mainstation in a cascade?

$\frac{32}{10} + 1 = 3.2 + 1 = 4.2$ dB

Thus, 4.2 dB is the maximum acceptable peak-to-valley deviation (highest peak to lowest valley in the broadband signal) at the 32nd Mainstation.

BROADBAND LEVEL & SLOPE CHARTS

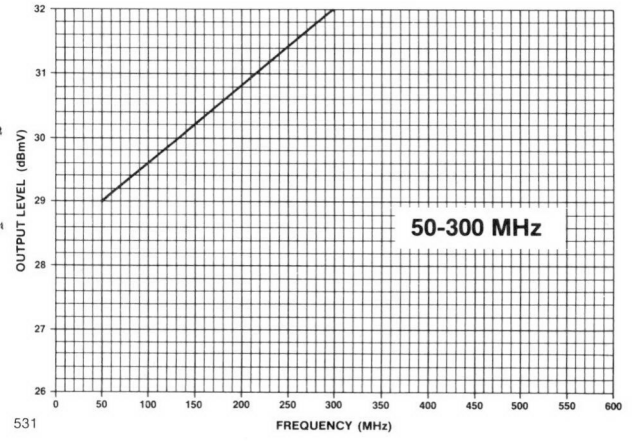
An Explanation

The charts on the next three pages show the broadband levels and slopes that Magnavox recommends for sub-split CATV systems whose highest design operating frequency is 300, 330, 400, 450, 550, or 600 MHz. These charts should be helpful in at least two situations.

(1) They help you find the level at which ASC and AGC pilot carriers must operate to maintain proper signal levels across the broadband spectrum. For example, Magnavox offers the 60 MHz/342 MHz pilot pair as ASC/AGC carriers for subscriber systems operating at 400 MHz (page 28). Each of these pilots lies somewhat inside the extremities of the 50-400 MHz bandwidth. If the system operator is to run 50 and 400 MHz at 26 and 32 dBmV respectively, at which levels must he operate the 60 and 342 MHz pilot carriers? Following the chart's curve on page 28, we see that the 60 MHz carrier should run at about 26.2 dBmV, and the 342 MHz carrier at 31 dBmV.

(2) If the highest frequency used in your CATV system is below the highest design frequency possible for your equipment, the charts will show you the proper level for the highest frequency you use. Consider, for example, a 330 MHz CATV system that uses frequencies up to only 312 MHz. As you can see on page 27, Magnavox's recommended level of 32 dBmV at 330 MHz translates to about 31.8 dBmV at 312 MHz.

BROADBAND LEVEL & SLOPE



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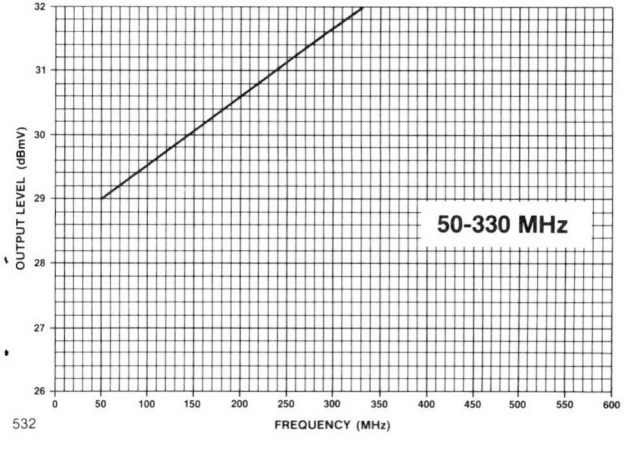

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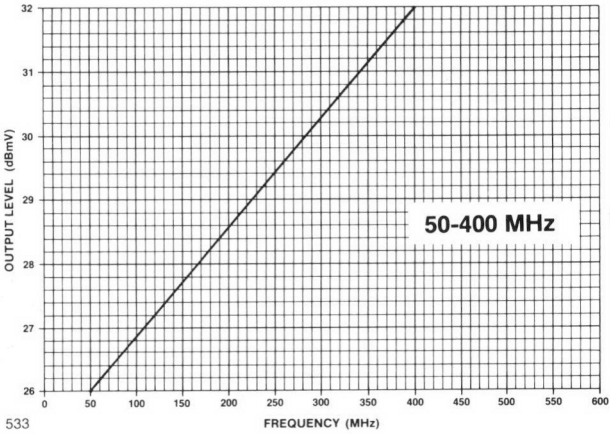
BROADBAND LEVEL & SLOPE



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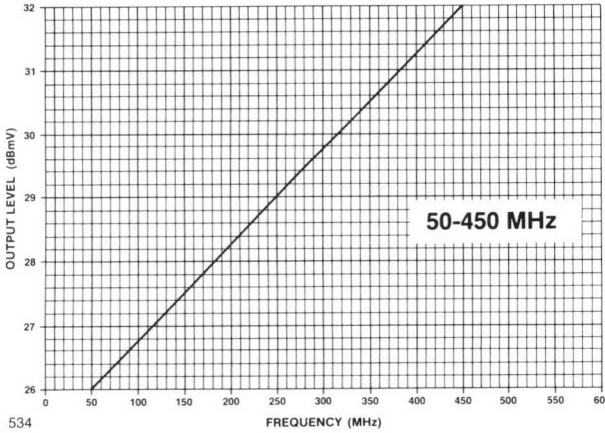

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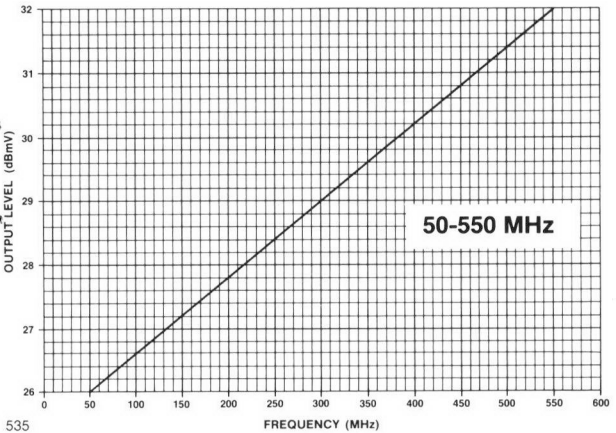
BROADBAND LEVEL & SLOPE



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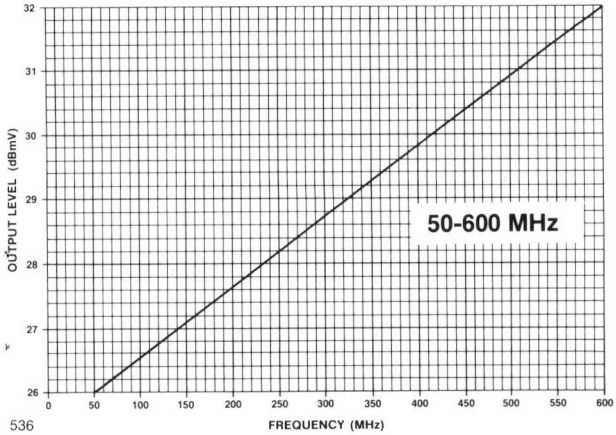


536

TV CHANNEL FREQUENCIES (MHz)

Color carrier appears at a frequency 3.58 MHz above the video carrier.

Converter channel numbering schemes vary. We have provided space for you to record your own system's numbering scheme under "Your Converter Number."

Channel Labeling Schemes			Headend Type					
	Standard	Your	Standard		HRC		IRC/ICC	
NCTA No.	Channels No.	Converter No.	Video	Sound	Video	Sound	Video	Sound
Sub Band								
T-7			7	11.5				
T-8			13	17.5				
T-9			19	23.5				
T-10			25	29.5				
T-11			31	35.5				
T-12			37	41.5				
T-13			43	47.5				
VHF Low Band								
2	2	___	55.25	59.75	54	58.5	55.25	59.75
3	3	___	61.25	65.75	60	64.5	61.25	65.75
4	4	___	67.25	71.75	66	70.5	67.25	71.75
5	5	___	77.25	81.75				
6	6	____	83.25	87.75				

FM Band								
					72	76.5	73.25	77.75
					78	82.5	79.25	83.75
					84	88.5	85.25	89.75
95	A-5	_ _ _	91.25	95.75	90	94.5	91.25	95.75
96	A-4	_ _ _	97.25	101.75	96	100.5	97.25	101.75
97	A-3	_ _ _	103.25	107.75	102	106.5	103.25	107.75
98	A-2	_ _ _	109.25	113.75	108	112.5	109.25	113.75
99	A-1	_ _ _	115.25	119.75	114	118.5	115.25	119.75
VHF Mid-Band								
14	A	_ _ _	121.25	125.75	120	124.5	121.25	125.75
15	B	_ _ _	127.25	131.75	126	130.5	127.25	131.75
16	C	_ _ _	133.25	137.75	132	136.5	133.25	137.75
17	D	_ _ _	139.25	143.75	138	142.5	139.25	143.75
18	E	_ _ _	145.25	149.75	144	148.5	145.25	149.75
19	F	_ _ _	151.25	155.75	150	154.5	151.25	155.75
20	G	_ _ _	157.25	161.75	156	160.5	157.25	161.75
21	H	_ _ _	163.25	167.75	162	166.5	163.25	167.75
22	I	_ _ _	169.25	173.75	168	172.5	169.25	173.75
VHF High Band								
7	7	_ _ _	175.25	179.75	174	178.5	175.25	179.75
8	8	_ _ _	181.25	185.75	180	184.5	181.25	181.75
9	9	_ _ _	187.25	191.75	186	190.5	187.25	191.75
10	10	_ _ _	193.25	197.75	192	196.5	193.25	197.75
11	11	_ _ _	199.25	203.75	198	202.5	199.25	203.75
12	12	_ _ _	205.25	209.75	204	208.5	205.25	209.75
13	13	_ _ _	211.25	215.75	210	214.5	211.25	215.75

TV CHANNEL FREQUENCIES (MHz)

Channel Labeling Schemes			Headend Type					
	Standard	Your	Standard		HRC		IRC/ICC	
NCTA No.	Channels No.	Converter No.	Video	Sound	Video	Sound	Video	Sound
VHF Super Band								
23	J	___	217.25	221.75	216	220.5	217.25	221.75
24	K	___	223.25	227.75	222	226.5	223.25	227.75
25	L	___	229.25	233.75	228	232.5	229.25	233.75
26	M	___	235.25	239.75	234	238.5	235.25	239.75
27	N	___	241.25	245.75	240	244.5	241.25	245.75
28	O	___	247.25	251.75	246	250.5	247.25	251.75
29	P	___	253.25	257.75	252	256.5	253.25	257.75
30	Q	___	259.25	263.75	258	262.5	259.25	263.75
31	R	___	265.25	269.75	264	268.5	265.25	269.75
32	S	___	271.25	275.75	270	274.5	271.25	275.75
33	T	___	277.25	281.75	276	280.5	277.25	281.75
34	U	___	283.25	287.75	282	286.5	283.25	287.75
35	V	___	289.25	293.75	288	292.5	289.25	293.75
36	W	___	295.25	299.75	294	298.5	295.25	299.75
Hyper Band								
37	AA	___	301.25	305.75	300	304.5	301.25	305.75
38	BB	___	307.25	311.75	306	310.5	307.25	311.75
39	CC	___	313.25	317.75	312	316.5	313.25	317.75
40	DD	___	319.25	323.75	318	322.5	319.25	323.75
41	EE	___	325.25	329.75	324	328.5	325.25	329.75

42	FF	_ _ _	331.25	335.75	330	334.5	331.25	335.75
43	GG	_ _ _	337.25	341.75	336	340.5	337.25	341.75
44	HH	_ _ _	343.25	347.75	342	346.5	343.25	347.75
45	II	_ _ _	349.25	353.75	348	352.5	349.25	353.75
46	JJ	_ _ _	355.25	359.75	354	358.5	355.25	359.75
47	KK	_ _ _	361.25	365.75	360	364.5	361.25	365.75
48	LL	_ _ _	367.25	371.75	366	370.5	367.25	371.75
49	MM	_ _ _	373.25	377.75	372	376.5	373.25	377.75
50	NN	_ _ _	379.25	383.75	378	382.5	379.25	383.75
51	OO	_ _ _	385.25	389.75	384	388.5	385.25	389.75
52	PP	_ _ _	391.25	395.75	390	394.5	391.25	395.75
53	QQ	_ _ _	397.25	401.75	396	400.5	397.25	401.75
54	RR	_ _ _	403.25	407.75	402	406.5	403.25	407.75
55	SS	_ _ _	409.25	413.75	408	412.5	409.25	413.75
56	TT	_ _ _	415.25	419.75	414	418.5	415.25	419.75
57	UU	_ _ _	421.25	425.75	420	424.5	421.25	425.75
58	VV	_ _ _	427.25	431.75	426	430.5	427.25	431.75
59	WW	_ _ _	433.25	437.75	432	436.5	433.25	437.75
60	XX	_ _ _	439.25	443.75	438	442.5	439.25	443.75
61	YY	_ _ _	445.25	449.75	444	448.5	445.25	449.75
62	ZZ	_ _ _	451.25	455.75	450	454.5	451.25	455.75
63		_ _ _	457.25	461.75	456	460.5	457.25	461.75
64		_ _ _	463.25	467.75	462	466.5	463.25	467.75
65		_ _ _	469.25	473.75	468	472.5	469.25	473.75
66		_ _ _	475.25	479.75	474	478.5	475.25	479.75

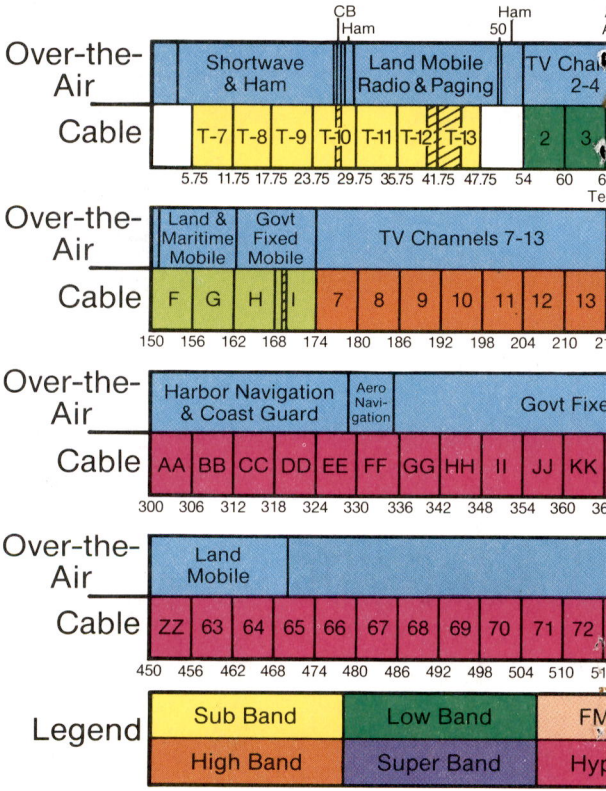
TV CHANNEL FREQUENCIES (MHz)

Channel Labeling Schemes			Headend Type					
	Standard	Your	Standard		HRC		IRC/ICC	
NCTA No.	Channels No.	Converter No.	Video	Sound	Video	Sound	Video	Sound
Hyper Band (Cont'd)								
67		___	481.25	485.75	480	484.5	481.25	485.75
68		___	487.25	491.75	486	490.5	487.25	491.75
69		___	493.25	497.75	492	496.5	493.25	497.75
70		___	499.25	503.75	498	502.5	499.25	503.75
71		___	505.25	509.75	504	508.5	505.25	509.75
72		___	511.25	515.75	510	514.5	511.25	515.75
73		___	517.25	521.75	516	520.5	517.25	521.75
74		___	523.25	527.75	522	526.5	523.25	527.75
75		___	529.25	533.75	528	532.5	529.25	533.75
76		___	535.25	539.75	534	538.5	535.25	539.75
77		___	541.25	545.75	540	544.5	541.25	545.75
78		___	547.25	551.75	546	550.5	547.25	551.75
79		___	553.25	557.75	552	556.5	553.25	557.75
80		___	559.25	563.75	558	562.5	559.25	563.75
81		___	565.25	569.75	564	568.5	565.25	569.75
82		___	571.25	575.75	570	574.5	571.25	575.75
83		___	577.25	581.75	576	580.5	577.25	581.75
84		___	583.25	587.75	582	586.5	583.25	587.75
85		___	589.25	593.75	588	592.5	589.25	593.75
86		___	595.25	599.75	594	598.5	595.25	599.75
87		___	601.25	605.75	600	604.5	601.25	605.75

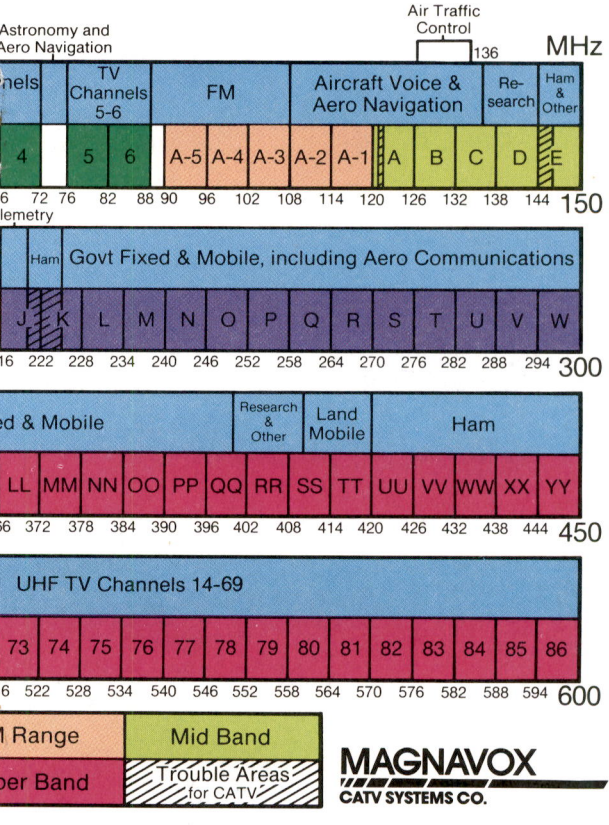
FM BROADCAST CHANNEL FREQUENCIES (MHz)

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	88.1	35	94.9	69	101.7
2	88.3	36	95.1	70	101.9
3	88.5	37	95.3	71	102.1
4	88.7	38	95.5	72	102.3
5	88.9	39	95.7	73	102.5
6	89.1	40	95.9	74	102.7
7	89.3	41	96.1	75	102.9
8	89.5	42	96.3	76	103.1
9	89.7	43	96.5	77	103.3
10	89.9	44	96.7	78	103.5
11	90.1	45	96.9	79	103.7
12	90.3	46	97.1	80	103.9
13	90.5	47	97.3	81	104.1
14	90.7	48	97.5	82	104.3
15	90.9	49	97.7	83	104.5
16	91.1	50	97.9	84	104.7
17	91.3	51	98.1	85	104.9
18	91.5	52	98.3	86	105.1
19	91.7	53	98.5	87	105.3
20	91.9	54	98.7	88	105.5
21	92.1	55	98.9	89	105.7
22	92.3	56	99.1	90	105.9
23	92.5	57	99.3	91	106.1
24	92.7	58	99.5	92	106.3
25	92.9	59	99.7	93	106.5
26	93.1	60	99.9	94	106.7
27	93.3	61	100.1	95	106.9
28	93.5	62	100.3	96	107.1
29	93.7	63	100.5	97	107.3
30	93.9	64	100.7	98	107.5
31	94.1	65	100.9	99	107.7
32	94.3	66	101.1	100	107.9
33	94.5	67	101.3		
34	94.7	68	101.5		

The Magnavox CATV Fre



equency Allocation Chart



MAGNAVOX
CATV SYSTEMS CO.

MAINSTATION OPERATING LEVELS AND DESIGN CRITERIA

The Forward Path

Parameter	Franchise Section A	B	C	
Trunk Output Levels				
at highest freq. of _____ MHz	_____	_____	_____	dBmV
at lowest freq. of _____ MHz	_____	_____	_____	dBmV
Slope across forward broadband	_____	_____	_____	dB
Trunk Gain	_____	_____	_____	dB
Trunk Input Level at Highest Freq.	_____	_____	_____	dBmV
Bridger Output				
with 1-way Bridger Splitter				
at highest frequency	_____	_____	_____	dBmV
at lowest frequency	_____	_____	_____	dBmV
with 2-way Bridger Splitter				
at highest frequency	_____	_____	_____	dBmV
at lowest frequency	_____	_____	_____	dBmV
with 3-way Bridger Splitter				
at highest frequency	_____	_____	_____	dBmV
at lowest frequency	_____	_____	_____	dBmV
with 4-way Bridger Splitter				
at highest frequency	_____	_____	_____	dBmV
at lowest frequency	_____	_____	_____	dBmV

Specs at Last Mainstation in Cascade	Temperature Bal Worst	Bal Worst	Bal Worst	
Carrier-to-Noise	_____	_____	_____	dB
Carrier-to-CTB	_____	_____	_____	dB
Carrier-to-Discrete 2nd Order	_____	_____	_____	dB
Carrier-to-Discrete 3rd Order	_____	_____	_____	dB
Peak-to-Valley Deviation	_____	_____	_____	dB

MAINSTATION OPERATING LEVELS AND DESIGN CRITERIA

The Return Path

Parameter	Franchise Section A	B	C	
Total Number of Return Modules				
Return Trunk Output Levels				
at highest freq. of _____ MHz				dBmV
at lowest freq. of _____ MHz				dBmV
Slope across return broadband				dB
Return Trunk Gain				dB
Return Trunk Input Level				
at highest frequency				dBmV
at lowest frequency				dBmV
Return Feeder Input Levels				
with 1-way Bridger Splitter				
at highest frequency				dBmV
at lowest frequency				dBmV
with 2-way Bridger Splitter				
at highest frequency				dBmV
at lowest frequency				dBmV
with 3-way Bridger Splitter				
at highest frequency				dBmV
at lowest frequency				dBmV
with 4-way Bridger Splitter				
at highest frequency				dBmV
at lowest frequency				dBmV

	Temperature						
	Bal	Worst	Bal	Worst	Bal	Worst	
Specs at Headend							
Carrier-to-Noise							dB
Carrier-to-CTB							dB
Carrier-to-Discrete 2nd Order							dB
Carrier-to-Discrete 3rd Order							dB
Peak-to-Valley Deviation							dB

FEEDERLINE OPERATING LEVELS AND DESIGN CRITERIA

The Forward Path

Parameter	Cascade Depth		
	One LE	Two LEs	
Line Extender Output Levels			
at highest freq. of _____ MHz	_____	_____	dBmV
at lowest freq. of _____ MHz	_____	_____	dBmV
Slope across forward broadband	_____	_____	dB
Line Extender Input Levels			
at highest frequency	_____	_____	dBmV
at lowest frequency	_____	_____	dBmV
Line Extender Gain	_____	_____	dB
Tap Output Level (Minimum)			
at highest frequency	_____	_____	dBmV
at lowest frequency	_____	_____	dBmV
Window (Neg. Reverse Slope)	_____	_____	dB

Specs at End of Line	Temperature		
	Bal	Worst	
Carrier-to-Noise	_____	_____	dB
Carrier-to-CTB	_____	_____	dB
Carrier-to-Discrete 2nd Order	_____	_____	dB
Carrier-to-Discrete 3rd Order	_____	_____	dB
Peak-to-Valley Deviation	_____	_____	dB

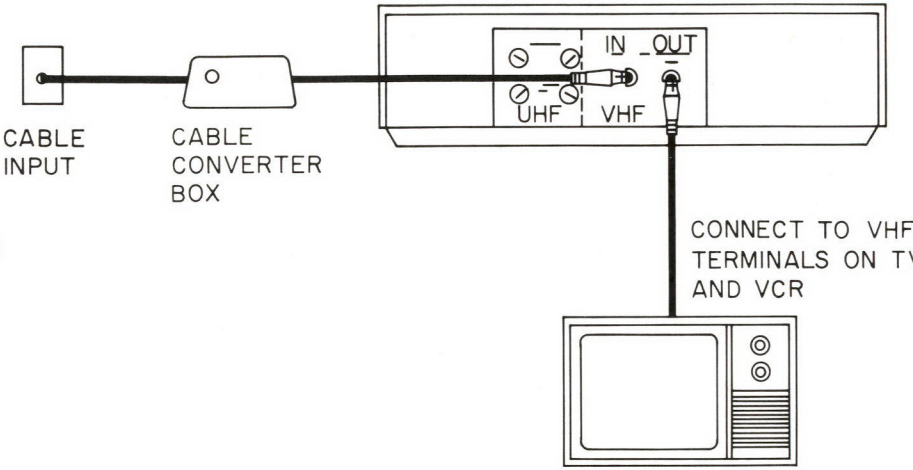
FEEDERLINE OPERATING LEVELS AND DESIGN CRITERIA

The Return Path

Parameter	Cascade Depth: One LE	Cascade Depth: Two LEs	
Total Number of Return Line Extender Modules	_____	_____	
Return Line Extender Output Levels			
at highest freq. of _____ MHz	_____	_____	dBmV
at lowest freq. of _____ MHz	_____	_____	dBmV
Slope across forward broadband	_____	_____	dB
Return Line Extender Input Levels			
at highest frequency	_____	_____	dBmV
at lowest frequency	_____	_____	dBmV
Return Line Extender Gain	_____	_____	dB

Specs: Signal Entering Mainstation	Temperature: Bal	Temperature: Worst	
Carrier-to-Noise	_____	_____	dB
Carrier-to-CTB	_____	_____	dB
Carrier-to-Discrete 2nd Order	_____	_____	dB
Carrier-to-Discrete 3rd Order	_____	_____	dB
Peak-to-Valley Deviation	_____	_____	dB

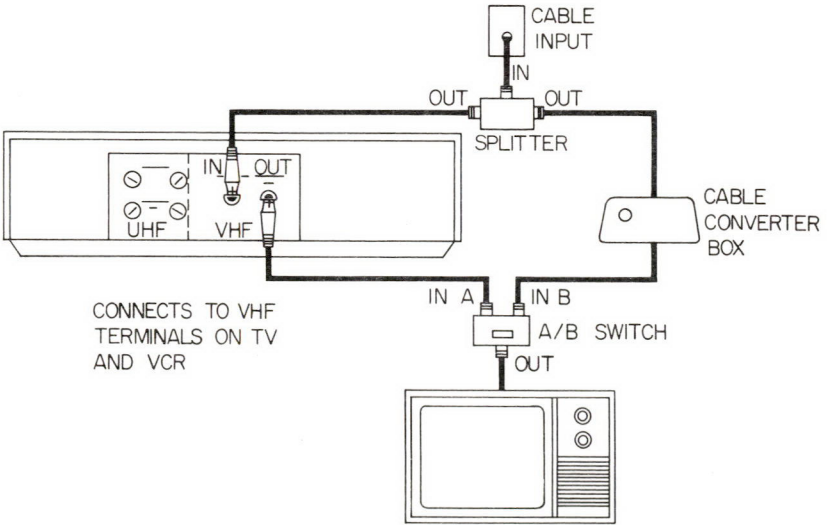
HOOK-UPS FOR CABLE/VCR COMBINATIONS — TV NOT CABLE-READY



515

Lets you record and view the same channel, scrambled or not.

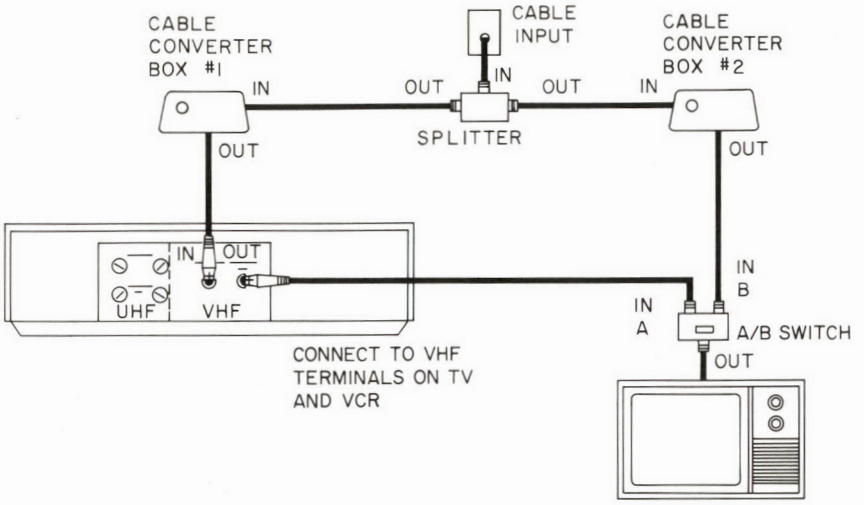
HOOK-UPS FOR CABLE/VCR COMBINATIONS — TV NOT CABLE-READY



518

Lets you record an unscrambled channel and view another channel, scrambled or not.

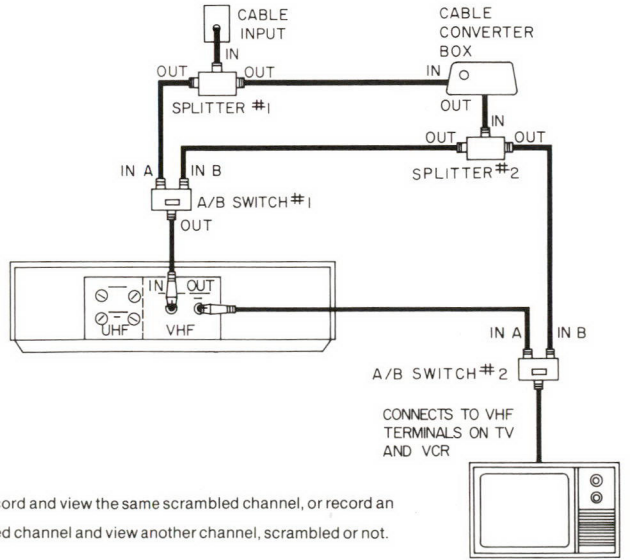
HOOK-UPS FOR CABLE/VCR COMBINATIONS — TV NOT CABLE-READY



516

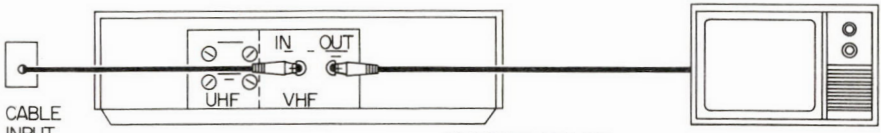
Lets you record one channel, scrambled or not, while viewing another channel, scrambled or not.

HOOK-UPS FOR CABLE/VCR COMBINATIONS — TV NOT CABLE-READY



Lets you record and view the same scrambled channel, or record an unscrambled channel and view another channel, scrambled or not.

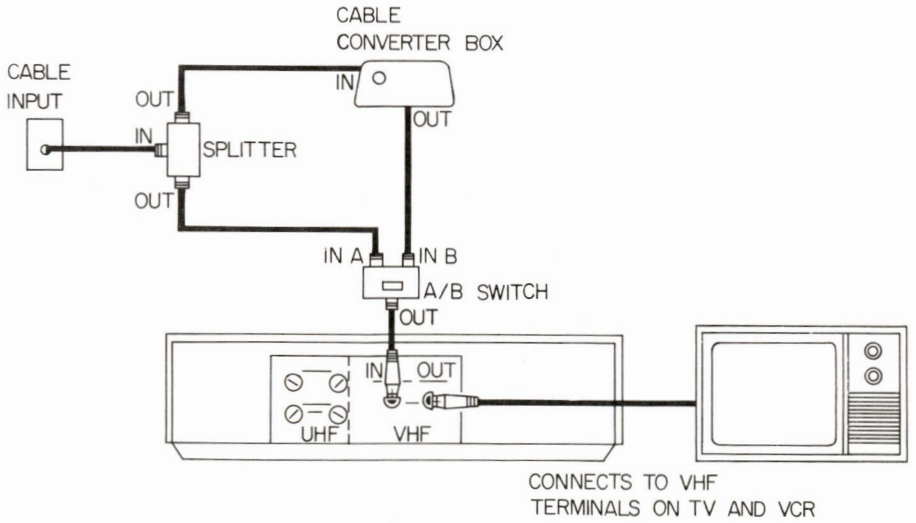
HOOK-UPS FOR CABLE/VCR COMBINATIONS — CABLE-READY TV



521

Lets you record and view an unscrambled channel.

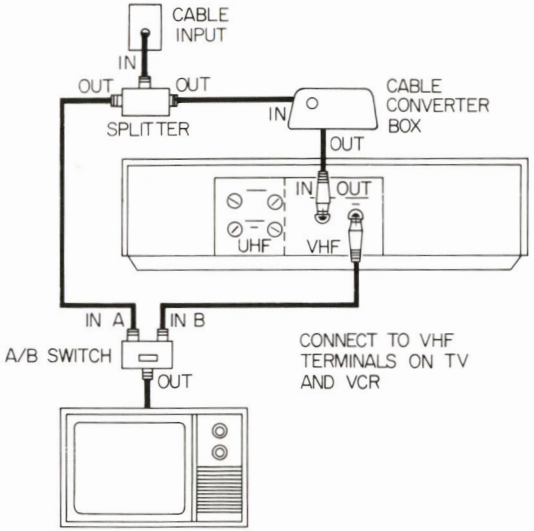
HOOK-UPS FOR CABLE/VCR COMBINATIONS — CABLE-READY TV



519

Lets you record and view the same scrambled channel.

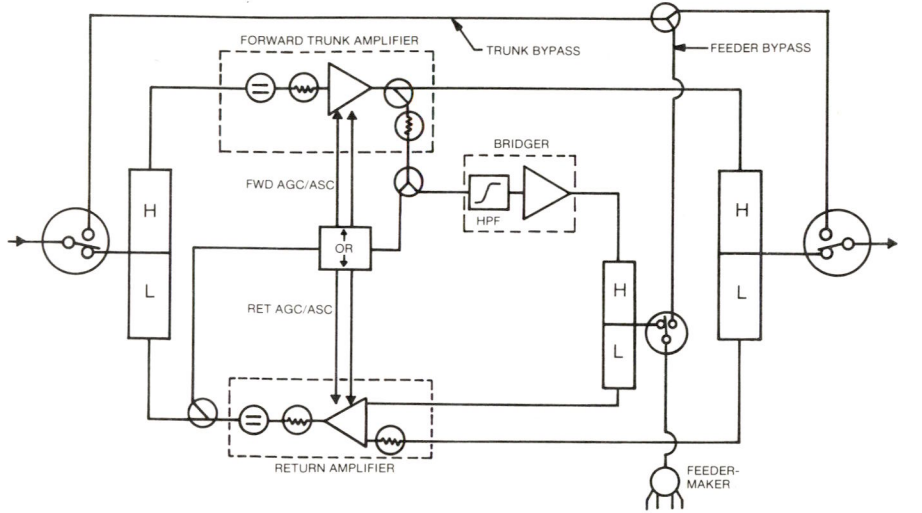
HOOK-UPS FOR CABLE/VCR COMBINATIONS — CABLE-READY TV



517

Lets you record one channel, scrambled or not, and view that same channel or another unscrambled channel.

DIAGRAM FOR 600/550 MHz ISIS MAINSTATIONS

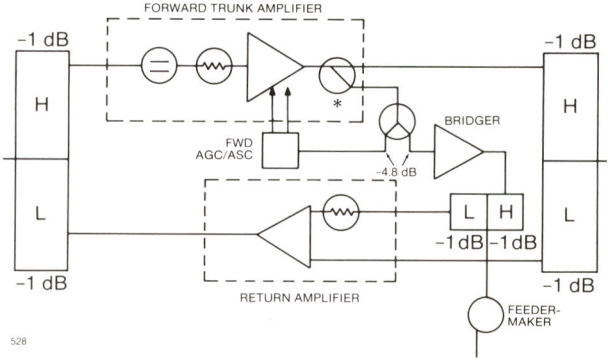


In the 600/550 MHz ISIS Mainstation diagrammed above, each filter section marked "L" passes signals in the return bandwidth (5-108 MHz); each one marked "H" passes signals in the forward bandwidth (150-600 MHz or 150-550 MHz). ISIS means **I**ntegrated **S**ubscriber/**I**nstitutional **S**ystem; ISIS equipment lets you operate a subscriber system and an institutional or LAN system on the same cable.

Magnavox makes equipment for 600 and 550 MHz subscriber systems as well. The block diagram shown above applies to subscriber systems also, except that you would use a slightly different return amplifier and AGC/ASC inputs would serve the Forward Trunk Amplifier only. In 600/550 MHz Subscriber Mainstations, each filter marked "L" passes signals in the 5-33 MHz return bandwidth; each one marked "H" passes signals in a forward bandwidth of either 50-600 MHz or 50-550 MHz.

DIAGRAM FOR SUB-SPLIT MAINSTATIONS

330 MHz & 450 MHz

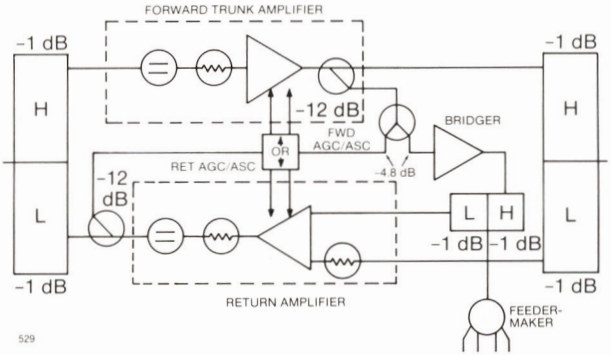


Each filter section marked "L" passes signals in the return bandwidth (5-30 MHz); each one marked "H" passes signals in the forward bandwidth (50-330 MHz or 50-450 MHz).

In the Forward Trunk Amplifier, signals pass through a directional coupler before leaving the Module. The tap leg loss for that directional coupler (marked * in the diagram) is different for different models: for high-gain Trunk Amp Modules (5-T330H, 6-T330H, and 6-T450H), the tap leg loss is 17 dB; you can order Feedforward Trunk Amp Modules whose directional couplers have either a 12 dB or a 21 dB tap leg loss; for other Forward Trunk Amp Modules, this tap leg loss is 12 dB.

DIAGRAM FOR MID-SPLIT MAINSTATIONS

"108" & "174" Bandsplits for 330 MHz & 450 MHz Systems



Each filter section marked "L" passes signals in the return bandwidth (5-108 MHz or 5-174 MHz); each one marked "H" passes signals in the forward bandwidth (174-330 MHz, 225-330 MHz, 174-450 MHz, or 225-450 MHz).

SELECTING AN ATTENUATOR FOR AN ACTIVE MODULE

Follow these steps to find an attenuator of the proper series and dB value for a given active module.

1. On the Equalizer & Attenuator Selection Chart (page 58), find the attenuator series used in the active module.

2. Determine how many dB of attenuation the active module needs.

3. Look up the available dB values for the attenuator series on the chart entitled "dB Values for Equalizers & Attenuators" (page 55).

4. Use the attenuator from that series whose dB value is closest to the amount of attenuation needed. Generally, unless the needed attenuation is only slightly above one of the available dB values for the series, it is better to use the next *higher* dB value available.

EXAMPLE: If your normal forward spacing between Mainstations (using 5-T440 Trunk Amps) is 22 dB but you are forced to install one after only 16 dB of cable, you would use a 4-A-6 attenuator in the Trunk Amplifier of the Mainstation following that short-spaced cable span.

dB VALUES FOR EQUALIZERS & ATTENUATORS

Equalizers

Series	dB Values (Final Suffix)
4-E-108	0, 3, 6, 9
4-E216	5, 8, 11, 14, 17, 20
4-E270	0, 7, 10, 13, 16, 19, 22
5-CE330	0, 5, 8, 11, 14, 17, 20
5-CE440A	0, 5, 8, 11, 14, 17, 20
5-EMD-108	0, 3, 6, 9, 12
5-EMD-174	0, 3, 6, 9, 12
5-2E330A	0, 5, 8, 11, 14, 17, 20
5-2E400	0, 5, 8, 11, 14, 17, 20
5-2E440A	0, 5, 8, 11, 14, 17, 20
5-2E550	0, 2, 5, 8, 11, 14, 17, 20
5-2E600	0, 2, 5, 8, 11, 14, 17, 20

Attenuators

Series	dB Values (Final Suffix)
4-A	0, 3, 6, 9, 12
4-A-T/15	3, 6, 9
5-A	3, 6, 9, 12
6-A	0, 1, 2, 3, 4, 5, 6, 9, 12, 15, 18
7-A	0, 1, 2, 3, 4, 5, 6, 9, 12, 15, 18

SELECTING AN EQUALIZER FOR AN ACTIVE MODULE

Follow these steps to find an equalizer of the proper series and dB value for a given active module.

1. On the Equalizer and Attenuator Selection Chart (page 58), find the equalizer series used in the active module according to the module's model number and the cable system's highest operating frequency. Note the equalizer derate figure for the equalizer series.

2. Determine how many dB of cable lie upstream of the active module's housing. For forward amplifier modules, you need to know how many dB of cable at the highest forward frequency are in the upstream cable span; for return amplifier modules, you need to know how many dB of cable at the highest return frequency are in the upstream cable span. The *same* upstream cable span determines the equalizer dB value for both the forward and return amplifiers in a Mainstation or Line Extender.

3. Subtract the equalizer derate figure (Step 1) from the dB of cable figure (Step 2). Note your result.

4. Look up the available dB values for the equalizer series on the chart entitled "dB Values for Equalizers and Attenuators" (page 55). If your result in Step 3 matches one of the available dB values, you have found the proper dB value for that active module. If the result in Step 3 falls between the listed dB values, use the equalizer from that series having the next *higher* dB value.

EXAMPLE: Suppose 16 dB of cable at 400 MHz precedes a Mainstation containing a 5-T440 Forward Trunk Amplifier. Which equalizer does the 5-T440 need?

Solution: The Selection Chart (page 58) says we need an equalizer from the 5-2E400 series, which has a derate figure of 6 dB. Knowing that 16 dB of cable at 400 MHz precedes this Mainstation, we subtract 6 dB from 16 dB to get 10 dB. The "dB Values Chart" (page 55) says that 5-2E400 equalizers come in 0, 5, 8, 11, 14, 17, and 20 dB values. Since the result of our subtraction (16 - 6 = 10 dB) falls between 8 dB and 11 dB, we choose the next higher dB value above 10 dB, i.e., the 11 dB equalizer from the 5-2E400 series.

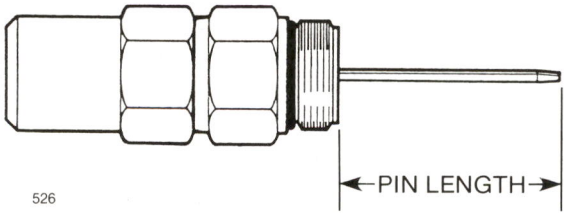
EQUALIZER & ATTENUATOR SELECTION CHART

Model Number of Active Module	Highest Operating Frequency (MHz)	Equalizer Series	Equalizer Derate	Attenuator Series
4-T270	216	4-E216	6	4-A
4-T270	270	4-E270	6	4-A
4-T300	216	4-E216	6	4-A
4-T300	270	4-E270	6	4-A
5-T300	216	4-E216	6	4-A
5-T300	270	4-E270	6	4-A
5-T300	300	5-2E330A	6	4-A
5-T330,-A,-B,-H,-HB	216	4-E216	6	4-A
5-T330,-A,-B,-H,-HB	270	4-E270	6	4-A
5-T330,-A,-B,-H,-HB	300	5-2E330A	6	4-A
5-T330,-A,-B,-H,-HB	330	5-2E330A	6	4-A
5-T440	400	5-2E400	6	4-A
5-T440	440, 450	5-2E440	6	4-A
5-T440-108	400, 440, 450	5-CE440A	5	4-A
5-T440-174	400, 440, 450	5-CE440A	4	4-A
5-T550	550	6-2E550	11	6-A
5-T600	600	6-2E600	11	6-A
6-T330,-H	300, 330	5-CE330	9	4-A
6-T450,-H	400, 440, 450	5-CE440A	9	4-A
6-T550	550	6-2E550	11	6-A
6-T600	600	6-2E600	11	6-A
6-T600P	600	6-2E600	11	5-A
8-T450H	400, 440, 450	5-CE440A	9	4-A
8-T550H	550	6-2E550	11	6-A
8-T550H -1	550	6-2E550	11	7-A
4-R108	108	4-E108	2	None
4-R108L	108	4-E108	2	None
5-RT108	108	5-E108	3	6-A
5-RTC108	108	5-E108	3	6-A
5-RT-174	174	5-E174	3	6-A
5-RTD-108,-108/DSS	108	5-EMD-108	3	6-A
5-RTD-174,-174/DSS	174	5-EMD-174	3	6-A
5-RTCD-108,-108/DSS	108	5-EMD-108	3	6-A
5-RTCD-174	174	5-EMD-174	3	6-A

EQUALIZER & ATTENUATOR SELECTION CHART (Cont'd)

Model Number of Active Module	Highest Operating Frequency (MHz)	Equalizer Series	Equalizer Derate	Attenuator Series
4-LE	216	4-E216	0	4-A
4-LE	270	4-E270	0	4-A
5-LE	216	4-E216	0	4-A
5-LE	270	4-E270	0	4-A
5-LE	300	5-2E300	0	4-A
5-LEX	270	4-E270	0	4-A
5-LEX	300, 330	5-2E330A	0	4-A
5-LEX34	216	4-E216	0	4-A
5-LEX34	270	5-2E330A	0	4-A
5-LEX34	300, 330	5-2E330A	0	4-A
5-MLE	400	5-2E440	0	4-A
5-MLE	440, 450	5-2E440	0	4-A
5-MLE-108	330	5-CE330	0	4-A
5-MLE-108	400, 440, 450	5-CE440A	0	4-A
5-MLE-174	400, 440, 450	5-CE440A	0	4-A
5-VLE60	550	6-2E550	9	7-A
5-GLE60	600	6-2E600	9	6-A
5-GLE60-108C	600	6-2E600	9	5-A
6-MLE	330	5-CE330	3	4-A
6-MLE	400, 440, 450	5-CE440A	3	4-A
6-MLE-108	330	5-CE330	2	4-A
6-MLE-108	400, 440, 450	5-CE440A	2	4-A
6-MLE-174	400, 440, 450	5-CE440A	2	4-A
6-MLEH	330	5-CE330	3	4-A
6-MLEH	400, 440, 450	5-CE440A	3	4-A
6-VLE60	550	6-2E550	9	7-A
6-GLE60	600	6-2E600	9	6-A

CONNECTOR PIN LENGTHS



This listing tells you what length a connector's pin must be if the connector is to fit a particular Magnavox distribution device.

Mainstations

Housing Number	Insert Type	Pin Length (inches)
5-TH/BE	Standard	1
5-TH/BE/EX	Extended	1-3/8
6-TH	Standard	11/16

Line Extenders

Housing Number	Insert Type	Pin Length (inches)
5-LH	Standard	1
5-LH/EX	Extended	1-3/8
6-LH	Standard	1
6-LH/EX	Extended	1-3/8

Return Carrier Modules

Series	Pin Length (inches)
5-RCG	1
5-RCF	1-1/4

CONNECTOR PIN LENGTHS (Cont'd)

Taps

Series	Number of Ports	Pin Length (inches)
4900	2, 4	3/4
4900	8	1-1/4
5900	2, 4	3/4
5900	8	1-1/4
5900A	2, 4	1
8000	2, 4, 8	1-1/8

Directional Couplers for Trunk and Feeder Lines

Series	Pin Length (inches)
49-TFC	1-1/4
59-ITFC	1-1/4
5-TFC	1-1/8
8-TFC	1-1/4

Distribution Slope Equalizers

Series	Pin Length (inches)
4900-DSE	3/4
8-DSE	1-1/8

Line Power Inserters

Series	Pin Length (inches)
49-LPI	1-1/4
59-ILPI	1-1/4
6-LPI	1-1/8
8-LPI	1-1/4

SPECS FOR 8000 SERIES TAPS

8000 Series, 8-way Taps

MODEL	TAP VALUE	INSERTION LOSS (max.) 5 MHz	30 MHz	50 MHz	330 MHz	400 MHz
8836	36	.4	.5	.5	.6	.6
8833	33	.4	.5	.5	.6	.6
8830	30	.4	.5	.5	.6	.6
8827	27	.6	.6	.6	.8	.8
8824	24	.6	.6	.6	.8	1.0
8821	21	1.0	1.0	1.0	1.1	1.1
8818	18	1.6	1.5	1.6	1.8	2.0
8815	15	3.2	3.0	2.9	3.2	3.4
8812	12					

8000 Series, 4-way Taps

MODEL	TAP VALUE	INSERTION LOSS (max.) 5 MHz	30 MHz	54 MHz	330 MHz	400 MHz
8435	35	.5	.4	.3	.4	.5
8432	32	.5	.4	.3	.4	.5
8429	29	.5	.4	.3	.4	.5
8426	26	.5	.4	.3	.4	.5
8423	23	.5	.4	.3	.4	.5
8420	20	.7	.6	.5	.6	.8
8417	17	.9	.8	.7	.8	1.0
8414	14	1.8	1.5	1.4	1.5	1.6
8412	12	3.2	2.8	2.7	2.9	3.1
8408	8					

8000 Series, 2-way Taps

MODEL	TAP VALUE	INSERTION LOSS (max.) 5 MHz	30 MHz	54 MHz	330 MHz	400 MHz
8232	32	.4	.3	.2	.4	.5
8229	29	.4	.3	.2	.4	.5
8226	26	.4	.3	.2	.4	.5
8223	23	.5	.4	.3	.4	.5
8220	20	.5	.4	.4	.4	.7
8217	17	.7	.6	.5	.6	.8
8214	14	.9	.8	.7	.8	1.2
8212	12	1.8	1.5	1.4	1.5	1.6
8208	8	3.2	2.8	2.7	2.9	3.1
8204	4					

SPECS FOR 8000 SERIES TAPS (Cont'd)

8000 Series, 8-way Taps

MODEL	INSERTION LOSS (max.) 450 MHz	500 MHz	600 MHz	MIN. ISOLATION TAP TO OUT (dB) 5-400 MHz	400-600 MHz
8836	.7	.9	.9	48	44
8833	.7	.9	.9	45	42
8830	.7	.9	.9	42	40
8827	1.0	1.1	1.1	39	38
8824	1.0	1.1	1.3	36	36
8821	1.3	1.4	1.6	35	34
8818	2.0	2.2	2.3	30	30
8815	3.4	3.6	3.7	28	27
8812					

8000 Series, 4-way Taps

MODEL	INSERTION LOSS (max.) 450 MHz	500 MHz	600 MHz	MIN. ISOLATION TAP TO OUT (dB) 5-600 MHz
8435	.7	.8	.9	44
8432	.7	.8	.9	42
8429	.7	.8	.9	40
8426	.7	.8	1.0	38
8423	.7	.8	1.0	36
8420	1.0	1.2	1.3	33
8417	1.3	1.5	1.6	30
8414	1.9	2.2	2.3	27
8412	3.3	3.6	3.7	24
8408				

8000 Series, 2-way Taps

MODEL	INSERTION LOSS (max.) 450 MHz	500 MHz	600 MHz	MIN. ISOLATION TAP TO OUT (dB) 5-600 MHz
8232	.7	.8	.9	42
8229	.7	.8	.9	40
8226	.7	.8	1.0	38
8223	.7	.8	1.0	36
8220	.9	1.0	1.1	33
8217	1.0	1.2	1.3	30
8214	1.3	1.5	1.6	27
8212	1.9	2.2	2.3	24
8208	3.3	3.6	3.7	22
8204				

SPECS FOR LINE SPLITTERS AND DIRECTIONAL COUPLERS

8-TFC Directional Couplers

Bandwidth: 5-600 MHz **Current Passing: 12 amperes**

MODEL	TAP LOSS 5-600	INSERTION LOSS (max.) 5 MHz	30 MHz	50 MHz	330 MHz
8-TFC-8	8.5±.5 dB	1.4	1.4	1.4	1.6
8-TFC-12	12.0±.5 dB	.9	.9	.9	1.1
8-TFC-16	16.0±1 dB	.7	.7	.7	.9

8-TFC Line Splitters

Bandwidth: 5-600 MHz **Current Passing: 12 amperes**

MODEL		SPLITTING LOSS (max.) 5 MHz	30 MHz	50 MHz	330 MHz
8-TFC-4		3.7	3.7	3.7	3.9
8-TFC-488	Leg 1	3.8	3.8	3.9	4.3
	Legs 2 & 3	7.1	7.1	7.1	7.4
8-TFC-666		5.9	5.9	5.9	6.1

SPECS FOR LINE SPLITTERS AND DIRECTIONAL COUPLERS (Cont'd)

8-TFC Directional Couplers

Bandwidth: 5-600 MHz **Current Passing: 12 amperes**

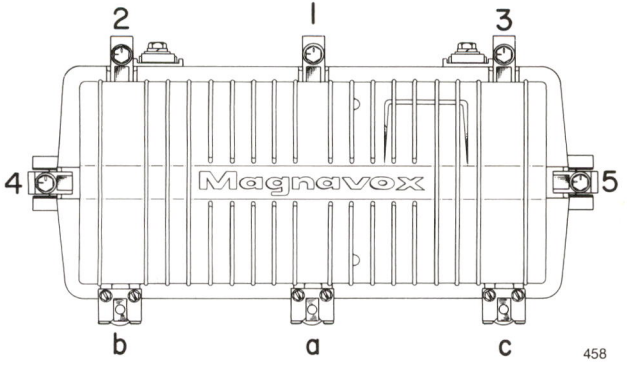
INSERTION LOSS (max.)				MIN. ISOLATION TAP-OUT (dB)	
400 MHz	450 MHz	500 MHz	600 MHz	10-450	450-600
1.8	1.8	2.0	2.0	23	20
1.3	1.3	1.6	1.6	27	24
1.1	1.1	1.3	1.3	30	20

8-TFC Line Splitters

Bandwidth: 5-600 MHz **Current Passing: 12 amperes**

INSERTION LOSS (max.)				MIN. ISOLATION TAP-TO-OUT (dB)	
400 MHz	450 MHz	500 MHz	600 MHz	10-450	450-600
4.0	4.0	4.2	4.2	30	27
4.6	4.6	4.9	4.9	30	27
7.6	7.6	7.9	7.9	25	25
6.4	6.4	6.8	6.8	23	18

TORQUE SPECS FOR MAINSTATIONS



Bolt-Tightening Patterns

Whenever you open a 5-TH or 6-TH Mainstation Housing, you should tighten the bolts in the order 1, 2, 3, 4, 5 (see figure) to reseal it. Go through this sequence twice, tightening each bolt to 45 inch-pounds on the first round and then to a final torque of 80-110 inch-pounds on the second round.

Tighten feeder port plugs and the -30 dB test point plugs to 30-40 inch-pounds.

If you should need to replace the cover altogether, the bottom hinge nuts a, b, and c should be tightened to a torque between 45 and 55 inch-pounds, again in two stages and in the order a, b, c (see figure).

TORQUE SPECS FOR FEEDERLINE EQUIPMENT

Line Extender Housings
Models 5-LH & 6-LH

Fitting	Inch-Pounds
Closure Bolts	30-40
Port Plugs	30-40
Test-Point Plugs	25-35

Taps
Model Series 3700, 3800, 4700, 4800, 4900, & 5900

Fitting	Inch-Pounds
Baseplate Closure Screws	30-40
Port Plugs	30-40

Line Splitters & Directional Couplers
Model Series 5-TFC, 5-ITFC, 59-TFC, 59-ITFC

Fitting	Inch-Pounds
Baseplate Closure Screws	30-40
Port Plugs	30-40

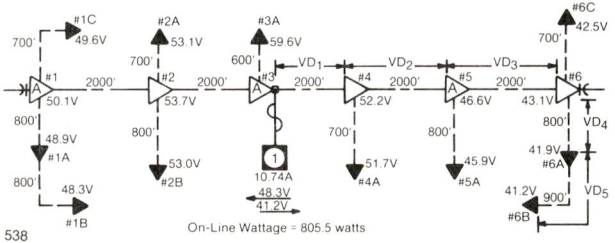
DISTRIBUTING POWER FROM LINE POWER SUPPLIES

An Example

Powering calculations like the ones in this example help you answer questions like:

(1) How many active devices will a line power supply serve?
(2) Where should I locate my line power supplies?, and
(3) How many line power supplies do I need to serve a section of my franchise?

The active modules in this example all contain push-pull amplifying hybrids. Each active module gets its DC power from a linear DC power supply (Magnavox's Model 7-PS).



LEGEND

= Mainstation with AGC/ASC Module, Bridger Module, and Return Module. Current Draw = .99 ampere.

= Mainstation with Bridger Module and Return Module. Current Draw = .94 ampere.

= Line Extender with Return Amplifier. Current Draw = .45 ampere.

= Line Power Inserter

= 60 VAC Line Power Supply. Maximum Output Current = 14 amperes.

= AC Blocking

= .750" Cable (.00076 ohm/foot)

= .500" Cable (.00168 ohm/foot)

We will plan to draw only 80% of the line power supply's maximum load current (80% x 14 = 11.2 amperes). We allow ourselves this "headroom" so the line power supply will not be overtaxed when summer temperatures increase cable attenuation, thereby increasing the current drawn from the line power supply.

The line power supply must also provide at least 40 VAC to each active device location.

Let us find the AC voltage that the line power supply will present to a distant active device, say line extender #6B.

Voltage at Line Extender #6B

Voltage at Line Extender #6B

$$= 60V - (VD_1 + VD_2 + VD_3 + VD_4 + VD_5)$$

To find the voltage drop (VD) across any cable span, you multiply the total current that the span must carry times the span's resistance (= resistance per foot x number of feet). See Legend in drawing to find Resistance-per-Foot figures.

1. **To find VD_1**. Current drawn by Mainstations 4, 5, and 6, and by Line Extenders 4A, 5A, 6A, 6B, and 6C, must all pass through this 2000' span of .750" cable.

$$I_{(total)} = (.94 + .99 + .94) + 5(.45) = 5.12 \text{ amperes}$$

$$VD_1 = I_{(total)} \times (.00076 \text{ ohm/ft} \times 2000 \text{ ft})$$

$$= 5.12 \text{ amperes} \times 1.58 \text{ ohms}$$

$$= 7.78 \text{ volts}$$

Voltage at Line Extender #6B (Cont'd)

2. **To find VD_2**. Current drawn by Mainstations 5 and 6 and by Line Extenders 5A, 6A, 6B, and 6C must all pass through this 2000' span of .750" cable.

$$I_{(total)} = (.99 + .94) + 4(.45) = 3.73 \text{ amperes}$$

$$VD_2 = I_{(total)} \times (.00076 \text{ ohm/ft} \times 2000 \text{ ft})$$

$$= 3.73 \text{ amperes} \times 1.58 \text{ ohms}$$

$$= 5.67 \text{ volts}$$

3. **To find VD_3**. Current drawn by Mainstation 6 and by Line Extenders 6A, 6B, and 6C must all pass through this 2000' span of .750" cable.

$$I_{(total)} = .94 + 3(.45) = 2.29 \text{ amperes}$$

$$VD_3 = I_{(total)} \times (.00076 \text{ ohm/ft} \times 2000 \text{ ft})$$

$$= 2.29 \text{ amperes} \times 1.58 \text{ ohms}$$

$$= 3.48 \text{ volts}$$

4. **To find VD_4**. Currents drawn by Line Extenders 6A and 6B must both pass through this 800' span of .500" cable.

$$I_{(total)} = 2(.45) = .9 \text{ ampere}$$

$$VD_4 = I_{(total)} \times (.00168 \text{ ohm/ft} \times 800 \text{ ft})$$

$$= .9 \text{ ampere} \times 1.344 \text{ ohms}$$

$$= 1.21 \text{ volts}$$

5. **To find VD_5**. Current drawn by Line Extender 6B must pass through this 900' span of .500" cable.

$$I_{(total)} = .45 \text{ ampere}$$

$$VD_5 = I_{(total)} \times (.00168 \text{ ohm/ft} \times 900 \text{ ft})$$

$$= .45 \text{ ampere} \times 1.512 \text{ ohms}$$

$$= .68 \text{ volt}$$

6. **Result**

Voltage at Line Extender #6B

$$= 60V - (VD_1 + VD_2 + VD_3 + VD_4 + VD_5)$$

$$= 60 - (7.78 + 5.67 + 3.48 + 1.21 + .68)$$

$$= 60 - 18.8$$

$$= 41.2 \text{ volts}$$

Considerations for 30 VAC Line Power Supplies

Suppose we had used a 30 VAC line power supply in the above example. How would our powering scheme differ? What must we keep in mind?

(1) Double the current draw figure for each active device.

(2) Note that most line power inserters allow a maximum current of 10 amperes for each output leg.

(3) The line power supply must provide at least 18 VAC to each active device location, unless that active uses Power Doubling™ hybrids; Power Doubling™ equipment needs at least 20 VAC. Each active device location will receive an input voltage between 18 and 30 VAC (a 12-volt range), instead of the 40-60 VAC (a 20-volt range) for systems powered by 60 VAC line power supplies.

Helpful Hints for System Powering

1. For any section of design to be powered by a given line power supply, add the current-draws for the active devices first to make sure that the total current to be drawn does not exceed the line power supply's limit. Only then should you proceed with voltage calculations like those in our example above.

2. Try not to locate line power supplies underground, on easements or transformer poles, at major intersections, etc.

3. If line power supplies are to be status-monitored, locate them within 400 feet of a Mainstation.

4. Mainstations equipped with Magnavox's Digital System Sentry draw .5 ampere more current than those without.

5. On-Line Wattage (O.L.W.) is the theoretical estimate of power drawn from the power company.

   When 7-PS Linear DC Power Supplies are used in Mainstations:

   O.L.W. = Total Current Drawn from Line Power Supply x 1.25 x Maximum Supply Voltage*

   When 8-PS Switching DC Power Supplies are used in Mainstations:

   O.L.W. = Total Current Drawn from Line Power Supply x 1.25 x 75% x Maximum Supply Voltage*

*Either 30 or 60 VAC.

MAGNAVOX

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